

## CONTENTS

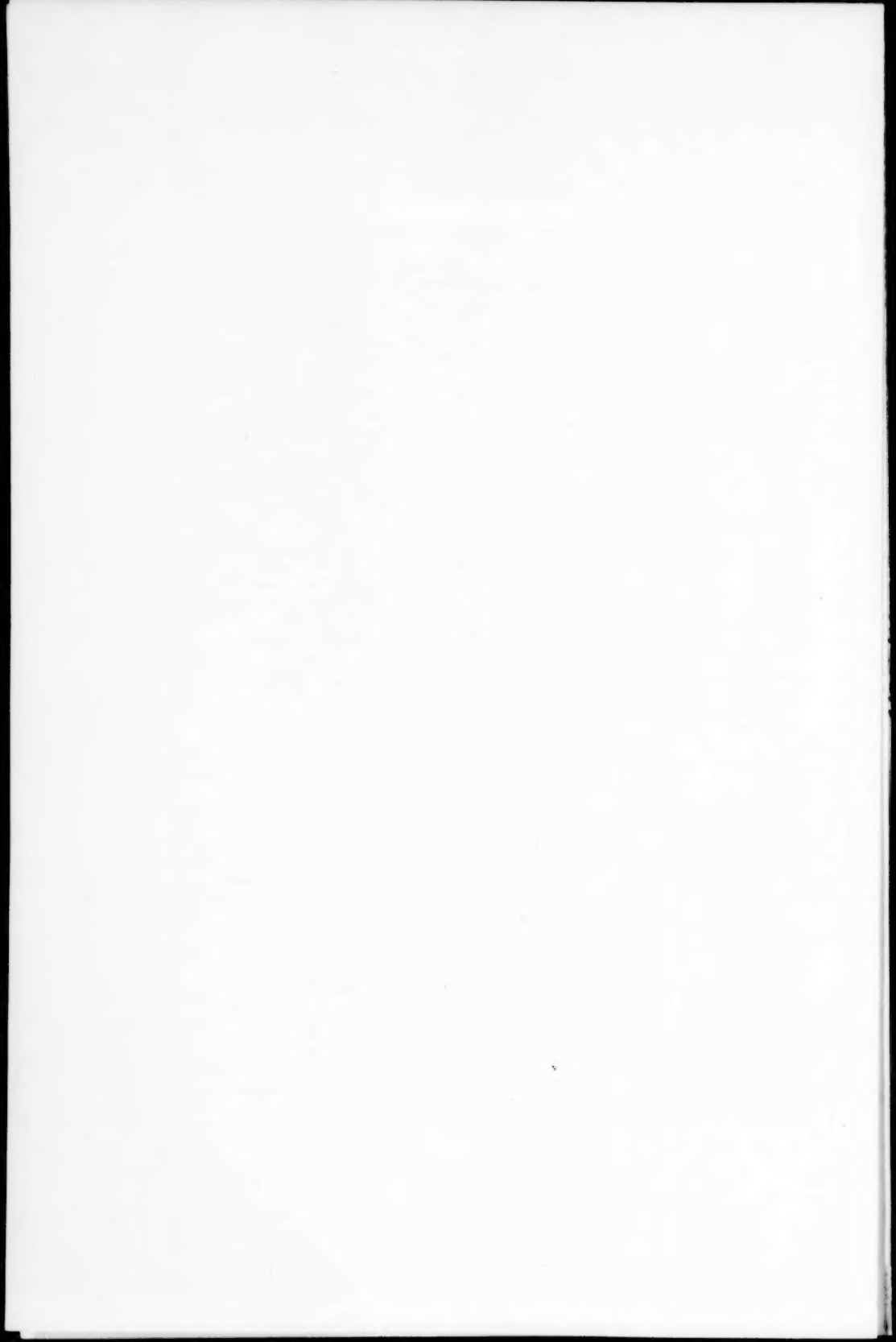
Chelates in Plant Nutrition. FIRMAN E. BEAR.....	1
Chelation and the Vertical Movement of Soil Constituents. H. J. ATKINSON AND J. R. WRIGHT.....	1
The Chemistry of Metal Chelates in Plant Nutrition. ARTHUR E. MARTELL.....	13
Some Aspects of the Use of Metal Chelates as Micronutrient Fertilizer Sources. A. WALLACE, L. M. SHANNON, O. R. LUNT, AND R. L. IMPEY.....	27
A Spectrophotometric Method of Analysis of Chelate Solutions and Its Application to the Study of Iron Chelates in Soils and Plants. D. G. HILL-COTTINGHAM.....	43
The Ferric Chelate of Ethylenediamine Di(O-Hydroxyphenylacetic Acid) for Treatment of Lime-Induced Chlorosis. HARRY KROLL.....	51
Uptake of Chelated Metals by Plants. P. C. DEKOCK AND R. L. MITCHELL.....	55
Response of Some Deciduous Fruit Trees to Zinc Chelates. N. R. BENSON, L. P. BATJER, AND I. C. CHMELIR.....	63
Response of Chlorotic Citrus Trees in Arizona to Soil Applications of Iron Chelates. J. RICHARD KUYKENDALL, ROBERT H. HILGEMAN, AND C. W. VAN HORN.....	77
Use of Chelates in Citrus Production in Florida. IVAN STEWART AND C. D. LEONARD.....	87
Investigations of Aminopolysaccharides in Soils: 2. Distribution of Hexosamines in Some Soil Profiles. F. J. STEVENSON.....	99
Absorption of Sulfur Dioxide from the Atmosphere by Cotton Plants. RALPH A. OLSEN.....	107
Some Factors Affecting the Adsorption of Cellulose Compounds, Pectins and Hemicellulose Compounds on Clay Minerals. D. L. LYNCH, L. M. WRIGHT, E. E. HEARNS, AND L. J. COTNOIR, JR.....	113
Soil Organic Matter-Metal Complexes: II. Cation-Exchange Chromatography of Copper and Calcium Complexes. F. E. BROADBENT.....	127
Fractionation of Soil Phosphorus. S. C. CHANG AND M. L. JACKSON.....	133
Calcium Uptake by Tomatoes as Influenced by Nature and Per Cent of Calcium Saturation of Ca-H-Clay Systems. PAUL ECK, MACK DRAKE, AND J. E. STECKEL.....	145
Influence of Various Factors on Aggregation of Peorian Loess by Microorganisms. T. M. MCCALLA, F. A. HASKINS, AND E. F. FROLIK.....	155
The Theory of Infiltration: 3. Moisture Profiles and Relation to Experiment. J. R. PHILIP.....	163
Book Reviews.....	179
A Comparison of Effects of Soil Moisture Tension and Osmotic Stress on Root Growth. J. R. GINGRICH AND M. B. RUSSELL.....	185
Characterizing Root Activity of Alfalfa by Radioactive Tracer Techniques. R. C. LIPPS, R. L. FOX, AND F. E. KOEHLER.....	195
The Effect of Differences in Soil-Moisture Status on Plant Growth. G. STANHILL.....	205
A Rapidly Equilibrating Soil Moisture Tensiometer. R. H. SEDGLEY AND R. J. MILLINGTON.....	215
Direct Use of pH Values in Statistical Analysis of Soil Reactions. CHERNG-JIANN SHIUE AND NAI LIN CHIN.....	219
Potassium Fixation in Soil of a Long-Term Fertility Trial with Citrus. P. F. PRATT AND BENOIST GOULBEN.....	225
Effect of Boron on Peanuts. HENRY C. HARRIS AND R. L. GILMAN.....	233
Influence of Low Temperatures on Nitrogen Transformations in Honeoye Silt Loam. B. J. STOJANOVIC AND F. E. BROADBENT.....	243
Loss of Ammonia from Ammonium Sulphate under Different Conditions When Applied to Soils. A. WAHHAB, M. S. RANDHAWA, AND S. Q. ALAM.....	249
The Theory of Infiltration: 4. Sorptivity and Algebraic Infiltration Equations. J. R. PHILIP.....	257
Book Reviews.....	265

The Continuous Ion Exchange. LAMBERT WIKLANDER AND KAAREL VAHTRAS. . . . .	269
Germination of Wheat as Affected by Biuret Contamination in Urea. D. E. SMIKA AND F. W. SMITH. . . . .	273
Moisture Profiles During Vertical Infiltration. E. G. YOUNGS. . . . .	283
The Mechanism by Which Water Moves Through a Porous Material Subjected to a Temperature Gradient: I. Introduction of a Vapor Gap Into a Saturated System. J. M. KUZMAK AND P. J. SEREDA. . . . .	291
Preliminary Experiments in the Development of Clay Orientation in Soils. R. BREWER AND A. D. HALDANE. . . . .	301
Soil Structural Evaluations with a Nonpolar Liquid. R. M. SMITH. . . . .	311
Effect of Complexing Agents on the Order of Cation Exchange on Kaolinite. JOSEPH A. SCHUFLE. . . . .	323
The Theory of Infiltration: 5. Influence of Initial Moisture Content. J. R. PHILIP. . . . .	329
A Note on the "Buckingham" Equation. K. L. BABCOCK AND ROY OVERSTREET. . . . .	341
Book Reviews. . . . .	345
Routine Determination of the Solids, Water, and Air Volumes Within Soil Clods of Natural Structure. P. J. RENNIE. . . . .	351
Physiological Disease of Rice. P. K. DE AND L. N. MANDAL. . . . .	367
Aluminum Effect on Potassium Fixation by Wyoming Bentonite. A. D. SCOTT, J. L. AHLRICHS, AND G. STANFORD. . . . .	377
Boron Contamination of Soil Samples Collected in Paper Bags. HERBERT W. WINSOR. . . . .	389
Qualitative Studies of Soil Microorganisms: XV. Capability of the Predominant Bacterial Flora for Synthesis of Various Growth Factors. A. G. LOCHHEAD. . . . .	395
Qualitative and Quantitative Chromatographic Analyses of the Carbohydrate Constituents of the Acid-Insoluble Fraction of Soil Organic Matter. D. L. LYNCH, L. M. WRIGHT, AND H. O. OLNEY. . . . .	405
Trace Element Delivering Capacity of 10 New Jersey Soil Types As Measured by Spectrographic Analyses of Soils and Mature Corn Leaves. ARTHUR L. PRINCE. . . . .	413
The Mechanism by Which Water Moves Through a Porous Material Subjected to a Temperature Gradient: 2. Salt Tracer and Streaming Potential to Detect Flow in the Liquid Phase. J. M. KUZMAK AND P. J. SEREDA. . . . .	419
Book Reviews. . . . .	423
Kinetics of Phosphate Uptake in the Soil-Plant System. MAURICE FRIED, C. E. HAGEN, J. F. SAIZ DEL RIO, AND J. E. LEGGETT. . . . .	427
Water Stability of Aggregates in Heated Soils. K. SUBBA RAO AND P. T. RAMACHARLU. . . . .	439
Use of 8(OH) Quinoline and Selenious Acid in Determining Available Phosphorus. M. O. GHANI AND A. ISLAM. . . . .	445
Diffusion-Porosity Measurements Using A Non-Steady State System. R. H. RUST, A. KLUTE, AND J. E. GIESEKING. . . . .	453
Adsorption of Plutonium by Soil. D. W. RHODES. . . . .	465
Adsorbed Na <sup>+</sup> , Cation-Exchange Capacity, and Percentage Na <sup>+</sup> Saturation of Alkali Soils. W. P. KELLEY. . . . .	473
Physico-Chemical Behavior of Clay-Conditioner Complexes. R. M. HOLMES AND S. J. TOTH. . . . .	479
Effect of Cropping Systems and VAMA on Soil Aggregation, Organic Matter, and Crop Yields. EDWARD STRICKLING. . . . .	489
Index. . . . .	499

# AUTHOR INDEX

(*Italic page numbers indicate senior authorship*)

- Ahlrichs, J. L., 377-387.  
 Alam, S. Q., 249-255.  
 Atkinson, H. J., 1-11.  
 Babcock, K. L., 341-343.  
 Batjer, L. P., 63-75.  
 Bear, F. E., 1.  
 Benson, N. R., 63-75.  
 Brewer, R., 301-309.  
 Broadbent, F. E., 127-131, 243-248.  
 Chang, S. C., 133-144.  
 Chin, N. L., 219-224.  
 Chmelir, I. C., 63-75.  
 Cotnoir, L. J., Jr., 113-126.  
 De, P. K., 367-376.  
 DeKock, P. C., 55-62.  
 Drake, M., 145-155.  
 Eck, P., 145-154.  
 Fox, R. L., 195-204.  
 Fried, M., 427-437.  
 Frolik, E. F., 155-161.  
 Ghani, M. O., 445-451.  
 Giesecking, J. E., 453-463.  
 Gilman, R. L., 225-232.  
 Gingrich, J. R., 185-194.  
 Goulben, B., 225-232.  
 Hagen, C. E., 427-437.  
 Haldane, A. D., 301-309.  
 Harris, H. C., 233-242.  
 Haskins, F. A., 155-161.  
 Hearn, E. E., 113-126.  
 Hilgeman, R. H., 77-86.  
 Hill-Cottingham, D. G., 43-49.  
 Holmes, R. M., 479-487.  
 Impey, R. L., 27-41.  
 Islam, A., 445-451.  
 Jackson, M. L., 133-144.  
 Kelley, W. P., 473-478.  
 Klute, A., 453-463.  
 Koehler, F. E., 195-204.  
 Kroll, H., 51-63.  
 Kuykendall, J. R., 77-86.  
 Kuzmak, J. M., 201-209, 419-422.  
 Leggett, J. E., 427-437.  
 Leonard, C. D., 87-97.  
 Lipps, R. C., 195-204.  
 Lochhead, A. G., 395-403.  
 Lunt, O. R., 27-41.  
 Lynch, D. L., 113-126, 405-411.  
 McCalla, T. M., 155-161.  
 Mandal, L. N., 367-376.  
 Martell, A. E., 13-26.  
 Millington, R. J., 215-217.  
 Mitchell, R. L., 55-62.  
 Olney, H. O., 405-411.  
 Olsen, R. A., 107-111.  
 Overstreet, R., 341-343.  
 Philip, J. R., 163-178, 257-264, 329-339.  
 Pratt, P. F., 225-232.  
 Prince, A. L., 413-418.  
 Ramacharlu, P. T., 439-443.  
 Randhawa, M. S., 249-255.  
 Rao, K. S., 439-443.  
 Rennie, P. J., 351-365.  
 Rhodes, D. W., 465-471.  
 Russell, M. B., 185-194.  
 Rust, R. H., 453-463.  
 Saiz del Rio, J. F., 427-437.  
 Schuffe, J. A., 323-328.  
 Scott, A. D., 377-387.  
 Sedgley, R. H., 215-217.  
 Sereda, P. J., 291-299, 419-422.  
 Shannon, L. M., 27-41.  
 Shiue, C. J., 219-224.  
 Smika, D. E., 273-282.  
 Smith, F. W., 273-282.  
 Smith, R. M., 311-322.  
 Stanford, G., 377-387.  
 Stanhill, G., 205-214.  
 Steckel, J. E., 145-155.  
 Stevenson, F. J., 99-106.  
 Stewart, I., 87-97.  
 Stojanovic, B. J., 243-248.  
 Strickling, E., 489-498.  
 Toth, S. J., 479-487.  
 Vahtras, K., 269-272.  
 Van Horn, C. W., 77-86.  
 Wahhab, A., 249-255.  
 Wallace, A., 27-41.  
 Wiklander, L., 269-272.  
 Winsor, H. W., 389-394.  
 Wright, J. R., 1-11.  
 Wright, L. M., 113-126, 405-411.  
 Youngs, E. G., 283-290.



## SUBJECT INDEX

- Aggregation, soil:**  
 by microorganisms, 155-161.  
 effect of cropping systems and VAMA on, 489-498.  
 stabilization of aggregates:  
   in normal and heated soils, 439-443.  
   reaction mechanisms in, 479-487.
- Air** within soil clods, determination of, 351-365.
- Alfalfa**, use of radioactive techniques to characterize root activity, 195-204.
- Alkali soils**, adsorbed  $\text{Na}^+$ , C.E.C., and  $\text{Na}^+$  saturation of, 473-478.
- Aluminum:**  
 effect of leachates on mobilization of, 3.  
 effect on K fixation by Wyoming bentonite, 377-387.
- Aminopolysaccharides** in soils, hexosamine distribution, 99-106.
- Ammonium sulphate**, loss of ammonia when applied to soils, 249-255.
- Apple trees**, response to Zn chelates, 65-71.
- Bentonite**, Wyoming, effect of Al on K fixation by, 377-387.
- Biuret** contamination in urea, effect on wheat germination, 273-282.
- Books reviewed.** *See listing at end of index.*
- Boron:**  
 contamination of soil samples collected in paper bags, 389-394.  
 effect on peanuts, 233-242.
- "Buckingham" equation**, a note on the, 341-343.
- Calcium:**  
 cation-exchange chromatography of complexes of, 127-131.  
 influence of Ca saturation of Ca-H-clay systems on plant uptake of, 145-154.
- Cation exchange:**  
 capacity of alkali soils, 473-478.  
 chromatography of Cu and Ca complexes, 127-131.  
 effect of complexing agents on the order of exchange on kaolinite, 323-328.
- Cellulose compounds**, adsorption on clay minerals, 113-126.
- Chelates:**  
 and vertical movement of soil constituents, 1-11.  
 as micronutrient fertilizer sources, 27-41.  
 chemistry of, 13-26.  
 in plant nutrition, 1, 13-26, 27-39, 55-62.  
 reactions in soil, 27-39.  
 response of fruit trees to, 63-75, 77-97.  
 soil *vs.* spray applications of, 39-41.  
 spectrophotometric analysis of solutions of, 43-49.
- Cherry trees**, response to Zn chelates, 65-67.
- Chlorosis**, iron, control of:  
 use of chelates, 51-53, 77-86.  
 use of spectrophotometric analyses, 43-49.
- Citrus trees:**  
 K fixation in soil, 225-232.  
 use of chelates in production of, 77-97.
- Clay systems:**  
 clay fixation of chelates, 30-31.  
 clay orientation in soils, 301-309.  
 influence on tomato Ca uptake of Ca saturation of Ca-H-clay systems, 145-154.  
 physico-chemical behavior of clay-conditioner complexes, 479-487.
- Conditioners**, soil, physico-chemical behavior of clay-conditioner complexes, 479-487.
- Copper**, cation-exchange chromatography of complexes of, 127-131.
- Cotton plants**, absorption of  $\text{SO}_2$  from air, 107-111.
- Cropping systems**, effect on soil aggregation, organic matter, and crop yields, 489-498.
- Diseases, plant:**  
 physiological diseases of rice, 367-376.  
*see also* Chlorosis, iron
- Fertilizers:**  
 K fixation in soil, 225-232.  
 use of metal chelates as micronutrient sources for, 27-41.
- Flora**, bacterial, and synthesis of growth factors, 395-403.
- Gases**, soil, diffusion-porosity measurements, 453-463.
- Hemicellulose compounds**, adsorption on clay minerals, 113-126.
- Hexosamines**, *see* Aminopolysaccharides.
- Honeoye silt loam**, influence of low temperature on N transformations in, 243-248.
- Infiltration**, theory of:  
 influence of initial moisture content, 329-339.

- Infiltration, theory of: (*continued*)  
 moisture profiles and relation to experiment, 163-178.  
 sorptivity and algebraic infiltration equations, 257-264.
- Ion exchange processes, continuous in soils, plants, and animals, 269-272.
- Iron:  
 distribution of, following spray applications of FeEDTA, 37-39.  
 effect of leachates on mobilization of, 3.  
 spectrophotometric analyses of chelate solutions, 43-49.
- Kaolinite, effect of complexing agents on the order of cation exchange on, 323-328.
- Micronutrients. *See* Trace elements.
- Microorganisms:  
 aggregation of Peorian loess by, 155-161.  
 bacterial flora capability for synthesis of growth factors, 395-403.
- Moisture, soil:  
 a rapidly equilibrating tensiometer, 215-217.  
 effect of:  
   status of on plant growth, 205-214.  
   tension and osmotic stress on root growth, 185-194.  
 mechanism by which water moves through a porous material subjected to a temperature gradient, 291-299, 419-422.  
 moisture profiles during vertical infiltration, 283-290.  
 note on the "Buckingham" equation, 341-343.  
 water volume in soil clod determination, 351-365.  
*see also* Infiltration, theory of
- Montmorillonite, adsorption of cellulose compounds, pectins, and hemicellulose compounds by, 113-126.
- Nitrogen, influence of low temperature on transformations of in soil, 243-248.
- Nutrition, plant, chelates in, 1, 13-26.
- Organic matter, soil:  
 analyses of carbohydrate constituents of the acid-soluble fraction of, 405-411  
 cation-exchange chromatography of Cu and Ca complexes, 127-131.  
 effect of cropping systems and VAMA on, 489-498.
- Paper bags, boron contamination of soil samples collected in, 389-394.
- Peach trees, response to Zn chelates, 65-71.
- Peanuts, effect of boron on, 233-242.
- Pectins, adsorption on clay minerals, 113-126.
- Peorian loess, aggregation by microorganisms, 155-161.
- pH (soil), and statistical analyses of soil reactions, 219-224.
- Phosphate uptake, kinetics of in soil-plant system, 427-437.
- Phosphorus, soil:  
 fractionation of, 133-144.  
 use of 8 (OH) quinoline and selenious acid in determining availability of, 445-451.
- Plants:  
 continuous ion exchange in, 269-272.  
 effect of differences in soil moisture status on, 205-214.  
 phosphorus uptake by, 427-437.  
 reaction of chelates in, 27-32.  
 uptake of metal chelates by, 55-62.  
 use of spectrophotometric analysis of chelate solutions, 43-49.  
*see also* Nutrition, plant; and Roots, plant.
- Potassium fixation:  
 a long-term fertility trial with citrus, 225-232.  
 aluminum effect on by Wyoming bentonite, 377-387.
- Plutonium, adsorption by soil, 465-471.
- Radioactive tracer techniques, use in characterizing alfalfa root activity, 195-204.
- Rice, physiological diseases of, 367-376.
- Roots, plant:  
 characterizing alfalfa root activity by radioactive tracer techniques, 195-204.  
 effect of soil moisture tension and osmotic stress on root growth, 185-194.
- Samples, soil, boron contamination of samples collected in paper bags, 389-394.
- Sodium, adsorbed  $\text{Na}^+$  and  $\text{Na}^+$  saturation of alkali soils, 473-478.
- Spectrographic analyses of soil and corn leaves, 413-418.
- Spectrophotometric analyses of chelate solutions, 43-49.
- Structures, soil:  
 chelation and soil formation, 1-11.

- determination of solids, water, and air volumes within soil clods, 351-363.
- evaluation of with a nonpolar liquid, 311-322.
- Sulfur dioxide from air, adsorption by cotton plants of, 107-111.
- Temperature (low), influence on N transformation in soil, 243-248.
- Tomato plants, Ca uptake by, influence of Ca saturation of Ca-H-clay systems, 145-154.
- Trace elements:
  - delivering capacity of soils, 413-418.
  - metal chelates as micronutrient fertilizer sources, 27-41.
- Urea, biuret contamination in, effect on wheat germination, 273-282.
- VAMA, effect on soil aggregation, organic matter, and crop yields, 489-498.
- Wheat germination as affected by biuret contamination in urea, 273-282.
- Yields, crop, effect of cropping systems and VAMA on, 489-498.





# BOOK REVIEWS

- American Oasis, The*, 179.  
*America's Natural Resources*, 179.  
*Analyse des Plantes et Problèmes des Fumures Minérales II*, 265.  
*Analysis of the Neutralization Curves of the Colloidal Acids*, An, 265.  
Anderson, A. W., 267.  
*Annual Review of Plant Physiology*, vol. 8, 345.  
*Arbeitsgemeinschaft für Forschung des Landes Nordrhein-Westfalen, Heft 60*, 179.  
Barner, J., 423.  
Barnes, K. K., 425.  
Baum, E. L., 181, 266.  
Bennett, H., 345.  
*Bibliographie des Sols de France*, 423.  
*Bibliography of Plant Protection 1946-1947*, 423.  
*Biochemical Individuality*, 345.  
Blackmore, J., 266.  
*Botany—An Introduction to Plant Science*, 2nd ed., 180.  
Bourlière, F., 349.  
*Calcium Phosphates and Their Importance in Nitrogen Fixation and Alkali Soil Reclamation*, 423.  
Callison, C. H., 179.  
Carles, J., 182.  
*Census of India, 1951*, vol. 1, part 1-A, 424.  
Chandler, W. H., 180.  
*Chemical Formulary, The*, 345.  
*Chemistry of Plants*, 346.  
Cochran, W. G., 425.  
Cofalaswami, R. A., 424.  
*Contribution to the Knowledge of the Importance of Sodium for Plant Life*, A., 424.  
Cook, J. G., 426.  
Cox, G. M., 425.  
Crafts, A. S., 345.  
Davis, J. R., 425.  
*Deciduous Orchards*, 3rd ed., 180.  
Dhar, N. R., 423.  
Dickson, J. G., 424.  
*Dictionary of Microbiology*, 180.  
*Diseases of Field Crops*, 2nd edition, 424.  
*Dry Farming in the Northern Great Plains 1900-1955*, 346.  
Dufay, J., 182.  
Edminster, T. W., 425.  
*Elementary Soil and Water Engineering*, 425.  
*Ergebnisse der 8. Deutschen Arbeitsbesprechung über Fragen der Unkrautbiologie und -bekämpfung*, 425.  
*Evaporation and Evapotranspiration Research in the United States and Other Countries*, 425.  
*Experimental Designs*, 2nd ed., 425.  
*Farm Trouble*, 180.  
Fawcett, N. C., 184, 265.  
*Federal Farm Law Manual*, 181.  
*Fertilizer Innovations and Resource Use*, 181.  
*Fight for Food, The*, 426.  
*First One Hundred and Fifty Years, The*, 265.  
Flint, R. F., 347.  
Frevert, R. K., 425.  
Fuller, H. J., 267.  
*Galactic Nebulae and Interstellar Matter*, 182.  
Gerstein, M. J., 180.  
Gilman, J., 183.  
*Glacial and Pleistocene Geology*, 347.  
*Grassland Seeds*, 347.  
Gupta, S. L., 265.  
Hargreaves, M. W. M., 346.  
Harroy, J.-P., 349.  
Heady, E. O., 181, 266.  
Higbee, E., 179.  
Hildreth, C. G., 181.  
Hill, D. D., 347.  
Howells, V., 183.  
Jacobs, M. B., 180.  
*Journal of Agricultural Engineering Research*, vol. 2, no. 1, 182.  
Kelly, W. C., 349.  
Keerekooper, H., 346.  
Korpela, A. E., 181.  
Lamer, M., 350.  
*Land Called Me, The*, 348.  
*Les Théories Pédologiques et Agronomiques de l'Académicien Williams*, 348.  
*Light, Vegetation and Chlorophyll*, 182.  
Lott, W. L., 426.  
Lounamaa, J., 348.  
McDowell, C. H., 267.  
*Manual of Aquatic Plants*, A., 266.  
*Manual of Soil Fungi*, A., 2nd ed., 183.  
Margulis, H., 348.  
Medcalf, J. C., 426.  
*Metal Chelates in Coffee*, 426.  
*Methodological Procedures in the Economic Analysis of Fertilizer Use Data*, 266.  
Miller, E. V., 346.  
*Modern Chemistry for the Engineer and Scientist*, 183.  
*Must Men Starve*, 266.  
*Naturalist in Palestine*, A., 183.  
Oser, J., 266.  
Pesok, J. T., 181.  
Plaisance, G., 423.  
*Plant Pathology*, 2nd ed., 183.  
*Plant Protection Conference 1956*, 267.  
*Plants of the Bible*, 267.  
*Plant World, The*, 3rd ed., 267.  
Prevot, P., 265.  
Rademacher, B., 425.  
Robbins, W. W., 180.  
Robertson, G. R., 183.  
Rue, E. A. de la, 349.  
Russell, E. J., 348.  
Schwab, G. O., 425.  
*Short Dictionary of Mathematics*, A., 267.  
Sittig, M., 268.  
*Sodium, Its Manufacture, Properties and Uses*, 268.  
*Soil, Use and Improvement*, 268.  
Soth, L., 180.  
*Spring Flora of Wisconsin*, 3rd ed., 184.  
Stallings, J. H., 268.  
Stocking, C. R., 180.  
Terrien, J., 182.  
Thompson, H. C., 349.  
*Trace Elements in Plants Growing Wild on Different Rocks in Finland*, 348.

*Tropics, The*, 340.

Truffaut, G., 182.

*Une Étude Limnologique de la Chimie des Sédiments de  
Fond des Lacs de l'Ontario Méridional, Canada*, 346.

*Vegetable Crops*, 5th ed., 349.

Walker, J. C., 183.

Walter, W. G., 180.

Weier, T. E., 180.

Wheeler, W. A., 347.

Williams, R. J., 345.

*World Fertilizer Economy, The*, 350.

Wybenga, J. M., 424.

# SOIL SCIENCE

VOLUME 84  
JULY TO DECEMBER, 1957

RUTGERS UNIVERSITY  
NEW BRUNSWICK, NEW JERSEY  
U. S. A.

PUBLISHED BY  
THE WILLIAMS & WILKINS COMPANY  
BALTIMORE, MARYLAND

# SOIL SCIENCE

*Founded 1916 by Jacob G. Lipman*

Editor-in-Chief  
**FIRMAN E. BEAR**

Associate Editor  
**RUTH MARION FIELD**

## CONSULTING EDITORS

**WM. A. ALBRECHT**  
University of Missouri, Columbia

**R. B. ALDERFER**  
Rutgers University, New Brunswick New Jersey

**LYLE T. ALEXANDER**  
Plant Industry Station, Beltsville, Maryland

**W. H. ALLAWAY**  
Plant Industry Station, Beltsville, Maryland

**R. V. ALLISON**  
University of Florida, Belle Glade

**L. D. BAVER**  
Sugar Planters' Experiment Sta., Honolulu, T. H.

**C. A. BLACK**  
Iowa State College, Ames

**G. B. BODMAN**  
University of California, Berkeley

**C. A. BOWER**  
U. S. Regional Salinity Lab., Riverside, California

**RICHARD BRADFIELD**  
Cornell University, Ithaca, New York

**R. H. BRAY**  
University of Illinois, Urbana

**F. E. BROADBENT**  
University of California, Davis

**MARLIN G. CLINE**  
Cornell University, Ithaca, New York

**N. T. COLEMAN**  
North Carolina State College, Raleigh

**H. P. COOPER**  
Clemson Agr. College, Clemson, South Carolina

**O. W. DAVIDSON**  
Rutgers University, New Brunswick, New Jersey

**MACK DRAKE**  
University of Massachusetts, Amherst

**F. L. DULEY**  
University of Nebraska, Lincoln

**W. J. HANNA**  
Rutgers University, New Brunswick, New Jersey

**H. J. HARPER**  
Samuel Roberts Noble Found., Ardmore, Okla.

**STERLING B. HENDRICKS**  
Plant Industry Station, Beltsville, Maryland

**M. L. JACKSON**  
University of Wisconsin, Madison 6

**C. D. JEFFRIES**  
Pennsylvania State University, University Park

**HANS JENNY**  
University of California, Berkeley

**LOUIS T. KARDOS**  
Pennsylvania State University, University Park

**CHARLES E. KELLOGG**  
Soil Conservation Service, Washington 25, D. C.

**DON KIRKHAM**  
Iowa State College, Ames

**GEORGE W. KUNZE**  
Agr. and Mech. College of Texas, College Station

**KIRK LAWTON**  
Michigan State University, East Lansing

**PHILIP F. LOW**  
Purdue University, Lafayette, Indiana

**C. E. MARSHALL**  
University of Missouri, Columbia

**W. P. MARTIN**  
Minnesota Agr. Exp. Sta., St. Paul

**A. MEHLICH**  
North Carolina State College of Agr., Raleigh

**A. R. MIDGLEY**  
University of Vermont, Burlington

**P. D. MILLER**  
Cornell University, Ithaca, New York

**J. L. MORTENSEN**  
Ohio State University, Columbus

**A. G. NORMAN**  
University of Michigan, Ann Arbor

**J. B. PAGE**  
Agr. & Mech. Col. of Texas, College Station

**ROBERT W. PEARSON**  
U. S. Agr. Research Service, Auburn, Alabama

**MICHAEL PEECH**  
Cornell University, Ithaca, New York

**W. H. PIERRE**  
Iowa State College, Ames

**ARTHUR L. PRINCE**  
Rutgers University, New Brunswick, New Jersey

**E. R. PURVIS**  
Rutgers University, New Brunswick, New Jersey

**C. I. RICH**  
Virginia Polytechnic Institute, Blacksburg

**L. A. RICHARDS**  
U. S. Regional Salinity Lab., Riverside California

**M. B. RUSSELL**  
University of Illinois, Urbana

**C. J. SCHOLLENBERGER**  
Agricultural Experiment Station, Wooster, Ohio

**LYDD F. SEATZ**  
University of Tennessee, Knoxville

**ROY W. SIMONSON**  
Soil Conservation Service, Beltsville, Maryland

**ROBERT L. STARKEY**  
Rutgers University, New Brunswick, New Jersey

**STEPHEN J. TOTH**  
Rutgers University, New Brunswick, New Jersey

**S. C. VANDECAVEYE**  
State College of Washington, Pullman

**N. J. VOLK**  
Purdue University, Lafayette, Indiana

**SELMAN A. WAKSMAN**  
Rutgers University, New Brunswick, New Jersey

HONORARY CONSULTING EDITORS: F. J. Alway; H. H. Bennett; H. J. Conn; E. E. DeTurk; Willard Gardner; Jacob S. Joffe; W. P. Kelley; H. Lundegårdh; M. M. McCool; Sante Mattson; W. H. MacIntire; C. A. Mooers; C. O. Rost; E. J. Russell; Oswald Schreiner; John W. Shive; and E. Truog.

# CONTENTS

Spectrochemistry in Soil-Plant Research. FIRMAN E. BEAR.....	1
Spectrochemical Methods in Soil Investigations. R. L. MITCHELL.....	1
An Emission Spectrochemical Analytical System As A Tool in Plant-Nutrition and Soil Investigations. ALSTON W. SPECHT, E. JAMES KOCH, AND JOHN W. RESNICKY.....	15
The Spectrograph in Geochemistry and Cosmochemistry. L. H. AHRENS.....	33
Chemical Differentiation of a Weathered Loess from a Weathered Till. R. K. LEIN- INGER.....	43
Spectrochemical Analysis of Soils and Biological Materials. N. F. SHIMP, JANE CONNOR, A. L. PRINCE, AND F. E. BEAR.....	51
A Spectrographic Study of the Distribution of Trace Elements in Some Podzolic Soils. JANE CONNOR, N. F. SHIMP, AND J. C. F. TEDROW.....	65
Techniques and Applications of Spectroscopy in Plant Nutrition Studies. A. P. VAN- SELOW AND G. R. BRADFORD.....	75
Effect of Fertilizers and Organic Materials on the Cation-Exchange Capacity of an Irrigated Soil. P. F. PRATT.....	85
Influence of Certain Adsorbed Cations on Radish Seedling Development. HENRY A. SCHREIBER, LANNES E. DAVIS, AND ROY OVERSTREET.....	91
The Role of Soil Clay Minerals in Phosphorus Fixation. JOHN B. HEMWALL.....	101
Hygrophotographic Method for Depicting Soil Moisture. JOSEPH SIVADJIAN.....	109
Investigations of Aminopolysaccharides in Soils: I. Colorimetric Determination of Hexosamines in Soil Hydrolysates. F. J. STEVENSON.....	113
Relation Between Dithizone-Extractable Zinc in the Soil and Zinc Uptake by Corn Plants. H. F. MASSEY.....	123
New Fields for the Application of the Mitscherlich Equation: 2. Contribution of Soil Nutrient Forms to Plant Nutrient Uptake. A. MONEM BALBA AND ROGER H. BRAY.....	131
Hydrogen and Calcium Relationships of Calcareous Soils. C. V. COLE.....	141
Field Experience with the Neutron-Scattering Method of Measuring Soil Moisture. GORDON L. STEWART AND STERLING A. TAYLOR.....	151
Book Reviews.....	159
Effect of Crop Residues and Nitrogen Additions on Decomposition of an Ohio Muck Soil. G. STOTZKY AND J. L. MORTENSEN.....	165
Effect of Na and K on Corn and Crimson Clover Grown on Norfolk Sandy Loam at Two Residual K Levels. RALPH L. WEHUNT, MATTHIAS STELLY, AND W. O. COLLINS.....	175
Effect of Initial Water Content on Stability of Soil Aggregates in Water. C. R. PAN- BOKKE AND J. P. QUIRK.....	185
Rapid Determination of Water in Wet Soils. C. KINNEY HANCOCK AND ROBERT L. BURDICK.....	197
Genesis of Three Soils Derived from Wisconsin Till in New Jersey. R. D. KREBS AND J. C. F. TEDROW.....	207
Plant Utilization of Zinc from Various Types of Zinc Compounds and Fertilizer Ma- terials. LOUIS C. BOAWN, FRANK VIETS, JR., AND CARL L. CRAWFORD.....	219
Potassium Fixation in East Pakistan Soils Under Different Conditions. A.Q.M.B. KARIM AND M. A. MALEK.....	229
A Method for Volumetric Estimation of Sulphates in Soils and Irrigation Water. A. G. ASGHAR, M. A. QAYYUM, AND G. M. RANA.....	239
Book Reviews.....	243
Laboratory Studies on Salt Distribution in Furrow-Irrigated Soil with Special Refer- ence to the Pre-emergence Period. LEON BERNSTEIN AND MILTON FIREMAN.....	249
Effect of Degree of Base Saturation on Tolerance of Avocado Seedlings to Exchange- able Na and K in the Soil. J. P. MARTIN AND J. O. ERVIN.....	265
Some Physical Properties of Taupo Pumice Soils of New Zealand. R. Q. PACKARD.....	273

A Short Method of Obtaining Mean Weight-Diameter Values of Aggregate Analyses of Soils. R. E. YOUKER AND J. L. MCGUINNESS.....	291
A Descriptive Theory of Leaching. W. R. GARDNER AND R. H. BROOKS.....	295
Use of An Anion Exchange Resin to Eliminate Anion Interference in Calcium Determination by Flame Photometry. FRED ADAMS AND R. D. ROUSE.....	305
Agrobiologic Percentage Method of Evaluating Fertilizer Tests: V. Application to An Experiment on the Joint Effects of Nitrogen Fertilizer and Rates of Planting; Theory of Barrenness in Corn. O. W. WILLCOX.....	313
Thermodynamic Properties of Water Adsorbed on Soil Minerals: II. Kaolinite. J. REX GOATES AND S. JOHN BENNETT.....	325
Book Reviews.....	331
Interaction of Montmorillonite Clays with Polyelectrolyte. A. PACKER.....	335
The Theory of Infiltration: 1. The Infiltration Equation and Its Solution. J. R. PHILIP.....	345
High-Frequency Titrations of Clay Minerals. T. M. LAI, M. M. MORTLAND, AND ANDREW TIMNICK.....	359
Plant Uptake of Sr90, Y91, Ru106, Cs137, and Ce144 from Soils. E. M. ROMNEY, J. W. NEEL, H. NISHITA, J. H. OLAFSON, AND K. H. LARSON.....	369
Factors Influencing Nematode Control by Ethylene Dibromide in Soil. C. A. I. GORING AND C. R. YOUNGSON.....	377
Effect of Soil-Conditioning Polymers on the Cation-Exchange Capacity. L. E. ALLISON.....	391
Influence of Soil Types on the Mineral Composition of Corn Tissues as Determined Spectrographically. ARTHUR L. PRINCE.....	399
Influence of Soil Temperature on Cation Uptake in Barley and Soybeans. ARTHUR WALLACE.....	407
Book Reviews.....	413
Notes.....	417
Soil Organic Matter-Metal Complexes: 1. Factors Affecting Retention of Various Cations. F. E. BROADBENT AND J. B. OTT.....	419
Improvements in Determining Cation-Exchange Capacity of Soils. A. WAHHAB AND M. AHMAD.....	429
The Theory of Infiltration: 2. The Profile at Infinity. J. R. PHILIP.....	435
A Proposed Method for Estimating Reduction of Available Moisture in Saline Soils. ROBERT E. FOX.....	449
The Extra-Thermodynamics of Soil Moisture. K. L. BABCOCK AND ROY OVERSTREET.....	455
A Diffusion Chamber for Studying Soil Atmosphere. F. E. ROBINSON.....	465
Amelioration of Alkali Soil by Chemicals in Combination with Organic-Matter-like Weeds. W. P. MITRA AND HARI SHANKER.....	471
Methods of Evaluating Aggregate Stabilization by HPAN as It Is Affected by Various Inorganic Salts. M. B. JONES AND W. P. MARTIN.....	475
Formation of Nitrate from Ammonium Nitrogen in Soils: 2. Effect of Population of Nitrifiers. LLOYD R. FREDERICK.....	481
Application of the Brunauer, Emmett, and Teller Equation to Ethylene Dibromide Adsorption by Soils. J. J. JURINAK AND D. H. VOLMAN.....	487
Sterilization of Soil by Irradiation with an Electron Beam, and Some Observations on Soil Enzyme Activity. A. D. McLAREN, LOLA RESHETKO, AND W. HUBER.....	497
A Portable Pressure Filter. G. MOHAPATRA.....	503
Index.....	505

## AUTHOR INDEX

- Adams, F., and Rouse, R. D. Ca determination by flame photometry, 305-12.
- Ahmad, M. *See* Wahhab, A.
- Ahrens, L. H. The spectrograph in geochemistry, 33-41.
- Allison, L. E. Soil-conditioning polymers, 391-97.
- Asghar, A. G., Qayyum, M. A., and Rana, G. M. Volumetric estimation of sulphates, 239-41.
- Babcock, K. L., and Overstreet, R. Thermodynamics of soil moisture, 455-64.
- Balba, A. M., and Bray, R. H. The Mitscherlich equation: I, 131-39.
- Bear, F. E. Spectrochemistry in soil-plant research, 1. *See also* Shimp, N. F.
- Bennett, S. J. *See* Goates, J. R.
- Bernstein, L., and Fireman, M. Salt distribution in soil, 249-63.
- Boawn, L. C., Viets, Jr., F., and Crawford, C. L. Plant utilization of zinc, 219-27.
- Bradford, G. R. *See* Vanselow, A. P.
- Bray, R. H. *See* Balba, A. M.
- Broadbent, F. E., and Ott, J. B. Organic matter-metal complexes: I, 419-27.
- Brooks, R. H. *See* Gardner, W. R.
- Burdick, R. L. *See* Hancock, C. K.
- Cole, C. V. H and Ca in Calcareous soils, 141-50.
- Collins, W. O. *See* Wehant, R. L.
- Connor, J., Shimp, N. F., and Tedrow, J. C. F. Trace elements, 65-73.
- Crawford, C. L. *See* Boawn, L. C.
- Davis, L. E. *See* Schreiber, H. A.
- Ervin, J. O. *See* Martin, J. P.
- Fireman, M. *See* Bernstein, L.
- Fox, R. E. Moisture reduction in saline soils, 449-54.
- Frederick, L. R. Nitrate formation, 481-85.
- Gardner, W. R., and Brooks, R. H. Theory of leaching, 295-304.
- Goates, J. R., and Bennett, S. J. Soil mineral adsorption of water, 325-30.
- Goring, C. A. I., and Youngson, C. R. Nematode control, 377-89.
- Hancock, C. K., and Burdick, R. L. Water determination in wet soils, 197-205.
- Hemwall, J. B. Phosphorus fixation, 101-108.
- Huber, W. *See* McLaren, A. D.
- Jones, M. B., and Martin, W. P. Aggregate stabilization by HPAN, 475-79.
- Jurinak, J. J., and Volman, D. H. Soil adsorption of ethylene dibromide, 487-96.
- Karim, A. Q. M. B., and Malek, M. A. Potassium fixation, 229-38.
- Koch, E. J. *See* Specht, A. W.
- Krebs, R. D., and Tedrow, J. C. F. Three soils from Wisconsin till, 207-18.
- Lal, T. M., Mortland, M. M., and Timnick, A. Titrations of clay minerals, 359-68.
- Larson, K. H. *See* Romney, E. M.
- Leininger, R. K. Chemical weathering, 43-50.
- McGuinness, J. L. *See* Youker, R. E.
- McLaren, A. D., Reshetko, L., and Huber, W. Soil sterilization by irradiation, 497-502.
- Malek, M. A. *See* Karim, A. Q. M. B.
- Martin, J. P., and Ervin, J. O. Avocado tolerance to soil Na and K, 265-71.
- Martin, W. P. *See* Jones, M. B.
- Massey, H. F. Zinc uptake by corn plants, 123-29.
- Mitchell, R. L. Spectrochemical methods, 1-13.
- Mitra, S. P., and Shanker, H. Amelioration of alkali soil, 471-74.
- Mohapatra, G. A portable pressure filter, 503-504.
- Mortensen, J. L. *See* Stotzky, G.
- Mortland, M. M. *See* Lal, T. M.
- Neel, J. W. *See* Romney, E. M.
- Nishita, H. *See* Romney, E. M.
- Olafson, J. H. *See* Romney, E. M.
- Ott, J. B. *See* Broadbent, F. E.
- Overstreet, R. *See* Babcock, K. L. and Schreiber, H. A.
- Packter, A. Interaction of montmorillonite clays, 335-43.
- Packard, R. Q. Properties of pumice soils, 273-89.
- Panabokke, C. R., and Quirk, J. P. Stability of soil aggregates, 185-95.
- Phillip, J. R. Theory of infiltration, 345-357, 435-448.
- Pratt, P. F. C.E.C. of an irrigated soil, 85-89.
- Prince, A. L. Spectrographic analysis of plants, 399-405. *See also* Shimp, N. F.
- Qayyum, M. A. *See* Asghar, A. G.

- Quirk, J. P. *See* Panabokke, C. R.  
Rana, G. M. *See* Asghar, A. G.  
Reshetko, O. *See* McLaren, A. D.  
Resnick, J. W. *See* Specht, A. W.  
Robinson, F. E. Method for studying soil atmosphere, 465-69.  
Romney, E. M., Neel, J. W., Nishita, H., Olafson, J. H., and Larson, K. H. Plant uptake of radioactive materials, 369-76.  
Rouse, R. D. *See* Adams, F.  
Schreiber, H. A., Davis, L. E., and Overstreet, R. Radish seedling development, 91-99.  
Shanker, H. *See* Mitra, S. P.  
Shimp, N. F., Connor, J., Prince, A. L., and Bear, F. E. Soils and biological materials, 51-64. *See also* Connor, J.  
Sivadjian, J. Hygrophotographic method, 109-12.  
Specht, A. W., Koch, E. J., and Resnick, J. W. Plant nutrition and soils, 15-32.  
Stelly, M. *See* Wehunt, R. L.  
Stevenson, F. J. Aminopolysaccharides in soils, 113-22.  
Stewart, G. L., and Taylor, S. A. Soil moisture measurement, 151-58.  
Stotzky, G., and Mortensen, J. L. Decomposition of an Ohio muck soil, 165-74.  
Taylor, S. A. *See* Stewart, G. L.  
Tedrow, J. C. F. *See* Connor, J. and Krebs, R. D.  
Timnick, A. *See* Lai, T. M.  
Vanselow, A. P., and Bradford, G. R. Plant nutrition, 75-83.  
Viets, Jr., F. *See* Boawn, L. C.  
Volman, D. H. *See* Jurinak, J. J.  
Wahhab, A., and Ahmad, M. C.E.C. of soils, 429-33.  
Wallace, A. Soil temperature and plant C.E.C., 407-411.  
Wehunt, R. L., Stelly, M., and Collins, W. O. Na and K effect on corn and clover, 175-83.  
Willcox, O. W. Evaluating fertilizers: V., 313-24.  
Youker, R. E., and McGuinness, J. L. Aggregate analysis of soils, 291-94.  
Youngson, C. R. *See* Goring, C. A. I.



## SUBJECT INDEX

- Acidity (soil), effects on K fixation, 234.
- Adsorption (soil) of EDB, 487-96.
- Aggregates, soil:  
   method for weight-diameter values, 291-94.  
   stabilization of:  
     effect of initial water content, 185-95.  
     methods of evaluating by HPAN, VAMA, and IBMA, 475-79.
- Alfalfa:  
   effect of crop residues on decomposition of a muck soil, 165-74.  
   spectrographic analysis for B and P, 400.
- Alkali soils, ameliorating effects of sulfur, weeds, and gypsum, 471-74.
- Aluminum, role in P fixation, 101-108.
- Aminopolysaccharides in soils, colorimetric determination of hexosamines in soil hydrolysates, 113-22.
- Ammonium nitrogen in soils, formation of nitrate from, 481-85.
- Atmosphere (soil), a diffusion chamber for the study of, 465-69.
- Avocado seedlings, effect of base saturation on tolerance to exchangeable Na and K in soil, 265-71.
- Barley plants:  
   capacity to take up Sr90, Y91, Ru106, Cs137, and Ce144 fission products, 369-76.  
   influence of soil temperature on cation uptake, 407-11.
- Base saturation, effect on tolerance of avocado seedlings to exchangeable Na and K, 265-71.
- Bean plants:  
   capacity to take up Sr90, Y91, Ru106, Cs137, and Ce144 fission products, 369-76.  
   Zn utilization by, 220-21.
- Bentonite:  
   titration curves of, 359-68.  
   *see also* Sodium montmorillonite clays.
- Benzoylarginineamide, hydrolysis in sterile soil, 500-501.
- Books reviewed. *See listing at end of index.*
- Boron, chemical *vs.* spectrographic analysis of plant materials, 400-401.
- Brunauer, Emmett, and Teller equation, application of EDB adsorption by soils, 487-96.
- Calcareous soils, H and Ca relationships in, 141-50.
- Calcite, solubility of, 144-46.
- Calcium:  
   elimination of anion interference in flame photometry determination, 305-312.  
   relationship with H in calcareous soils, 141-50.
- Calcium carbonate, *see* Calcite.
- Calcium-hydrogen systems in soil, influence on radish seedling development, 91-99.
- Calcium-magnesium systems, influence on radish seedling development, 91-99.
- Calcium montmorillonite clays, interaction with polyelectrolyte, 335-43.
- Calcium-sodium systems in soil, influence on radish seedling development, 91-99.
- Carbon (soil), effect of mineral fertilizer on, 85-89.
- Carboxymethylcellulose, interaction with montmorillonites, 336-38.
- Carrot plants, capacity to take up Sr90, Y91, Ru106, Cs137, and Ce144 fission products, 369-76.
- Cation-exchange capacity, soil:  
   effects of:  
     fertilizers and organic materials, 85-89.  
     VAMA, HPAN, and IBMA, 391-97.  
     improved method for determination of, 429-33.
- Cations:  
   factors affecting retention by soil organic matter-metal complexes, 419-27.  
   influence of soil temperature on uptake in barley and soybeans, 407-11.
- Cesium, enrichment in fossil chitin, 40.
- Chitin (fossil), cesium enrichment in, 40.
- Citrus, long-term fertility trial, 85-89.
- Clay minerals, soil:  
   associated with Wisconsin drift, 212-14.  
   high-frequency titrations of, 359-68.  
   interaction with polyelectrolyte, 335-43.  
   rapid method of determining, 417-18.  
   role in P fixation, 101-108.
- Clover plants, relative effects of Na and K on, 175-83.
- Conditioners, soil:  
   effect on soil C.E.C., 391-97.  
   effectiveness in stabilizing aggregates, 475-79.

**Corn plants:**

- effect of plant population and nitrogen levels on hybrids, 320.
- influence of soil type on mineral composition of tissues, 399-405.
- relative effects of Na and K on, 175-183.
- theory of barrenness in, 313-24.
- Zn uptake by, 123-29.

**Cosmochemistry, use of spectrographic methods, 33-41.****Crop residues, decomposition of a muck soil, 165-74.****Drought, plant resistance to, 111-12.****EDB (ethylene dibromide):**

- adsorption by soils, 487-95.
- nematode control by, 377-89.

**EDTA, plant utilization of Zn from, 220.****Enzyme activity, some observations on, 497-501.****Fertility, long-term trial with citrus, 85-89.****Fertilizers, effects:**

- of N fertilizers and rates of planting, 313-24.
- on C.E.C. of an irrigated soil, 85-89.
- on K fixation, 229-34.
- for Zn deficiencies, 219-27.
- see also* Mitscherlich equation, 131-39.

**Filter, a portable pressure model, 503-504.****Fission products, uptake capacity of plants, 369-76.****Fumigation, soil, 377-89.****Geochemistry, use of spectrographic methods, 33-41.****Gypsum, amelioration of alkali soils, 471-74.****Heat of the earth and radioactivity, 39-40.****Hectorite, *see* Sodium montmorillonite clays.****Hexosamines, colorimetric determination in soil hydrolysates, 113-22.****HPAN:**

- effects on soil C.E.C., 391-97.
- effectiveness in stabilizing aggregates, 475-79.

**Human tissues, spectrochemical methods of analysis, 51-63.****Hydrogen, relation to Ca in calcareous soils, 141-50.****Hydrolysates (soil), colorimetric determination of hexosamines in, 113-22.****IBMA:**

- effects on soil C.E.C., 391-97.
- effectiveness in stabilizing aggregates, 475-79.

**Illite, titration curves of, 359-68.****Infiltration, theory of:**

- infiltration equation and its solution, 345-357.
- profile at infinity, 435-48.

**Irrigation, effect on salt accumulation, 256-57.****Kaolinite:**

- thermodynamic properties of water adsorbed on, 325-30.
- titration curves of, 359-68.

**Leaching, a descriptive theory, 295-304.****Lettuce plants, capacity to take up Sr90, Y91, Ru106, Cs137, and Ce144 fission products, 369-76.****Loess, demarcation between weathered till and loess, 43-50.****Minerals (plant), influence of soil type on corn tissue composition, 399-405.****Minerals, soil:**

- age estimates of, 38-39.
- in soils associated with Wisconsin drift, 210-12, 216-17.
- thermodynamic properties of water adsorbed on, 325-30.
- see also* Clay minerals, soil.

**Mitscherlich equation, 131-39, 313-24.****Moisture, soil:**

- effect on K fixation, 235
- extra-thermodynamics of, 455-64.
- estimating reduction of in saline soils, 449-54.
- in pumice soils, 282-89.
- methods of measurement:
  - hygrophotographic, 109-12.
  - neutron-scattering, 151-58.

**Muck soil, effect of crop residues and nitrogen on decomposition of, 165-74.****Nematode control by EDB in soil, 377-89.****Nitrate formation from ammonium nitrogen in soils, 481-85.****Nitrogen, effect on decomposition of a muck soil, 165-74.****Nutrition, plant:**

- influence of soil temperature, 407-11.
- spectrochemical studies of, 15-32, 75-83.
- Organic matter-metal complexes, factors affecting cation retention by, 419-27.
- pH (soil), and Zn uptake by corn plants, 123-29.

**Phosphate, effect on C.E.C. of an irrigated soil, 85-89.****Phosphorus:**

- chemical *vs.* spectrographic methods of plant analysis, 400-401.

- role of soil clay minerals in P fixation, 101-108.  
 uptake by wheat plants, 131-39.
- Planting, effect of rate of, 313-24.
- Plants:  
   spectrographic analysis, 15-32, 51-64, 75-83.  
   uptake of radioactive materials, 369-76.  
   utilization of Zn, 219-27.
- Polyelectrolyte, interaction with montmorillonite clays, 335-43.
- Potash, effect on C.E.C. of an irrigated soil, 85-89.
- Potassium:  
   effects of:  
     base saturation on plant tolerance to, 265-71.  
     mineral fertilizers on soil K, 85-89.  
     Na and K on corn and crimson clover, 175-83.  
     geochemical association with Rb, 33-35.  
     fixation in East Pakistan soils, 229-38.
- Pumice soils, some physical properties of, 273-89.
- Radioactivity:  
   and the earth's heat, 39-40.  
   plant uptake of Sr90, Y91, Ru106, Cs137, and Ce144, 369-76.
- Radish plants:  
   capacity to take up radioactive materials, 369-76.  
   influence of adsorbed cations on seedling development, 91-99.
- Ragweed, spectrographic analysis for trace elements, 404.
- Rubidium, geochemical association with Tl and K, 33-35.
- Rye, effect of crop residues on decomposition of a muck soil, 165-74.
- Saline soils:  
   estimating reduction of available moisture, 449-54.  
   salt distribution in furrow-irrigated soil, 249-63.
- Sodium:  
   effects of:  
     base saturation on seedling tolerance to, 265-71.  
     Na and K on corn and crimson clover, 175-83.  
   interaction of montmorillonite clays with polyelectrolyte, 335-43.
- Soil series. *See listing at end of index.*
- Soil suspension, a portable pressure filter, 503-504.
- Sorghum, Zn utilization by, 222-23.
- Soybeans, influence of soil temperature on cation uptake, 407-11.
- Spectrochemical methods of analysis:  
   cosmo chemistry, 33-41.  
   geochemistry, 33-41.  
   human tissues, 51-64.  
   plants, 15-32, 51-64, 75-83, 399-405.  
   soils, 1-13, 15-32, 51-75.  
   weathered loess, 43-50.
- Sterilization (soil) by irradiation with an electric beam, 497-501.
- Strawberry plants, spectrochemical analysis of leaves, 25-32.
- Sulfate, volumetric estimation of in soils and irrigation water, 239-41.
- Sulfur, amelioration of alkali soils, 471-74.
- Temperature, soil:  
   effect on K fixation, 236.  
   influence on plant cation uptake, 407-11.
- Thallium, geochemical association with Rb, 33-35.
- Trace elements, *see* Spectrochemical methods of analysis.
- Urea:  
   effect on C.E.C. of an irrigated soil, 85-89.  
   hydrolysis in sterile soil, 499-500.
- VAMA:  
   effects on:  
     avocado growth in Na and K soils, 265-71.  
     C.E.C. of soils, 391-97.  
   effectiveness in stabilizing aggregates, 475-79.
- Water, soil:  
   movement in porous media, 345-47.  
   rapid determination of in wet soils, 195-205.  
   spectrographic examination of, 82.  
   stability in soil aggregates, 185-95.  
   thermodynamic properties of in soil mineral adsorption, 325-30.  
   volumetric estimation of sulfates in irrigation water, 239-41.
- Weeds, amelioration of alkali soils, 471-74.
- Wheat plants:  
   effect of crop residues on decomposition of a muck soil, 165-74.  
   P uptake by, 131-39
- Zinc:  
   plant utilization of, 219-27.  
   uptake by corn plants, 123-29.

## BOOK REVIEWS

- Ackworth, B., 159.  
*Advances in Agronomy*, vol. 8, 243.  
*Agricultural Commodity Programs, The*, 331.  
 American Society of Sugar Beet Technologists, 161.  
 Andrews, F. S., 332.  
 Bayer, L. D., 414.  
 Benedict, M. R., 331.  
*Bibliography of Plant Protection*, 1950, 159.  
*Biological Sciences*, 243.  
*Bird and Butterfly Mysteries*, 159.  
*Borden's Review of Nutrition*, vol. 17, no. 5, 331.  
 Brown, W. L., 160.  
*Ceylon Coconut Quarterly*, vol. 6, nos. 1 and 2, 331.  
 Coalmining, 160.  
 Colin, E. C., 160.  
*Condensed Chemical Dictionary, The*, 5th. ed., 159.  
*Corn, And Its Early Fathers*, 160.  
 Correll, D. S., 243.  
*Days From Seventy-Five to Ninety*, 331.  
 Derruau, M., 246.  
 Dhar, N. J., 414.  
*Dictionary of Poisons*, 160.  
*Early Grist and Flouring Mills of New Jersey, The*, 243.  
 Edmond, J. B., 332.  
*Elements of Genetics*, 3rd ed., 160.  
*Estimating Irrigation Water Requirements from Meteorological Data*, 332.  
*Experimental Programs in Brazil*, 332.  
*Farmer Gives Thanks, The*, 161.  
*Ferns and Fern Allies of Texas*, 243.  
 Fisher, J. L., 414.  
 Floods, 244.  
 Flora, S. D., 245.  
*Fundamentals of Horticulture*, 2nd. ed., 332.  
*Future of Arid Lands, The*, 244.  
 Gold, V., 413.  
*Grassland Farming in The Humid Northeast*, 333.  
 Guard, S. R., 161.  
 Gustavson, R. G., 414.  
 Haber, E. S., 413.  
*Haslstroms of The United States*, 245.  
*Handbook For Vegetable Growers*, 333.  
 Hannan, R. S., 246.  
 Harris, E. J., 415.  
 Hewitt, E. R., 331.  
*Historical Background of Chemistry, The*, 413.  
 Holmes, R. M., 332.  
 Houk, I. E., 161.  
 Hoyt, W. G., 244.  
*Irrigation Engineering*, vol. 2, 161.  
*Journal of The American Society of Sugar Beet Technologists*, vol. 9, no. 2, 161.  
 Knott, J. E., 333.  
 Langbein, W. B., 244.  
*Lange's Handbook of Chemistry* 9th. ed., 162.  
 Leicester, H. M., 413.  
 Lott, W. L., 332.  
 Mahsted, J. P., 413.  
 Medcalf, J. C., 332.  
 Meier, R. L., 246.  
 Mellan, E., 160.  
 Mellan, I., 160.  
*Methods of Chemical Analysis for Soil Survey Samples*, 245.  
 Metson, A. J., 245.  
 Mooney, H. M., 162.  
 Munser, A. M., 332.  
 Nelson, W. L., 334.  
 Nuttinson, M. Y., 163.  
 Ogg, William, G., 162.  
*pH Measurements, Their Theory and Practice*, 413.  
*Plant Propagation*, 413.  
*Potassium Symposium*, 245.  
*Potentials About A Point Electrode And Apparent Resistivity Curves for a Two- Three- and Four-Layer Earth, The*, 162.  
*Précis de Géomorphologie*, 246.  
 Prince, F. S., 333.  
*Proceedings of The National Academy of Sciences, India*, vol. 24, sec. A., parts 1-6, 414.  
 Quinn, L. R., 332.  
 Radcliffe, A., 334.  
*Report of the Experiment Station Committee, Hawaiian Sugar Planters' Association, 1956*, 414.  
*Report of The Rothamsted Experimental Station for 1955*, 162.  
*Research on the Science and Technology of Food Preservation by Ionizing Radiations*, 246.  
*Resources for the Future, Annual Report, 1956*, 414.  
 Roberson, E. C., 334.  
 Robertson, G. W., 332.  
 Rose, A., 159.  
 Rose, E., 159.  
*Science and Economic Development*, 246.  
 Sim, R. J., 243.  
 Snedecor, G. W., 163.  
*Soil Conservation*, 415.  
*Soil and Plant Food*, vol. 2, no. 1, 333.  
*Soil Fertility and Fertilizers*, 334.  
*Soils and Soil Fertility*, 2nd. ed., 415.  
 Stallings, J. H., 415.  
 Statham, I. C. F., 160.  
*Statistical Methods*, 5th. ed., 163.  
 Stine, O. C., 331.  
*Symposium on the Use of Metal Chelates in Plant Nutrition*, 415.  
 Teeter, P. B., 332.  
 Teuscher, H., 164.  
 Thompson, L. M., 415.  
 Tisdale, S. L., 334.  
*Transport and Accumulation in Biological Systems*, 415.  
*True Book About Atomic Energy, The*, 334.  
 Wallace, H. A., 160.  
 Weiss, H. B., 243.  
 Wetzel, W. W., 162.  
*Wheat-Climatic Relationships and the Use of Phenology in Ascertaining the Thermal and Photo-thermal Requirements of Wheat*, 163.  
*Window-Box Gardening*, 164.

## SOIL SERIES

## Analyses, Descriptions of, or Experiments with

- Aiken, 369, 392, 492; Annandale, 66; Bedford, 124; Billings, 392; Blount, 115; Brookston, 475; Chino, 392; Cisne, 115, 132; Clermont, 482; Coltz, 401; Columbia, 92; Cookeville, 124; Cosayuna, 401; Crider, 124; Culleoka, 124; Decatur, 124; Drummer, 132; Dublin, 497; Esquatzel, 301; Fawcett, 124; Fiander, 392; Flanagan, 115, 132; Floyd, 468; Fort Collins, 147; Genesee, 482; Gila, 392; Grantsburg, 132; Guthrie, 124; Hagerstown, 124; Hanford, 92, 369, 379, 492; Herrick, 132; Holtville, 301, 391; Honcut, 92; Keene, 291; Lawrence, 124; Loradale, 124; Lowell, 124; Malheur, 392; Maury, 124; Mellott, 482; Meloland, 492; Mercer, 124; Miami, 475; Nevada, 92; Norfolk, 175; Norton, 66, 401; Pachappa, 251, 300, 391; Paulding, 475; Pembroke, 124; Rifle, 166; Ritaville, 219; Rockaway, 207; Rocklin, 92; Salinas, 492; Sango, 124; Sasafra, 401; Shelbyville, 124; Sorrento, 369; Squires, 66, 207; Staten, 92, 492; Swartwood, 207; Traver, 301; Umapine, 392; Urrbrae, 185; Vins, 369; Washington, 401; Wethersfield, 66; Yolo, 265, 353, 369, 446, 492.

